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West Europe Report

SCIENCE AND TECHNOLOGY

No. 34

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CONTENTS

TRANSPORTATION

STUDY CONTINUES ON OCEAN THERMAL ENERGY CONVERSION

Paris INDUSTRIES & TECHNIQUES in French 30 Jun 80 pp 117-118, 120, 122, 124, 129, 131

[Article by Philippe Dumez: "Hot and Cold in the Tropics"]

[Excerpts] Competitive kilowatt hours.... As early as 1930 a French physicist asked: Why not use temperature gradients between the surface and the bottom of the tropical seas to produce electricity? The idea was taken up by the United States, Japan, and France. We are rather focusing on open thermodynamics cycles which are better adapted to generate power ranging from 1 to 10 megawatts. The Americans and the Japanese go far beyond with their closed cycles. The new decade should see the completion of a number of projects.

"The principle of thermal energy of the seas consists of using one of the strangest physical phenomena. By this I mean the phenomenon which, in the tropical seas, through the paradoxical cooperation between the sun and the poles, maintains a rather high temperature differential, more or less constant, between the water on the surface which maintains a perpetual temperature between 25 and 30°C and the water at the bottom which, as a result of a slow current coming from the poles, remains in the vicinity of the freezing temperature level, i.e., 4 to 5°C at a 1,000 meter depth." This was stated by physicist Georges Claude in 1928! In the course of his thinking he conceived a thermodynamic process for the production of electric power. After a long period of neglect such studies have now been resumed by the Americans, the Japanese, and, recently, by France. At the CGE [General Electric Power Company] Jean Lacour has recently completed a feasibility study. All processes were studied, verified, and computed with, as one may imagine, facilities different from those used by G. Claude some 60 years ago! "He was right," Jean Lacour insists with great enthusiasm.

In France the initiative came from the National Center for the exploitation of the oceans. At the end of 1978 the CNEXO [National Center for the Exploitation of the Oceans] submitted the following requests to the CGE and Creusot-Loire-Empain groups:

- A survey of favorable sites in the overseas departments;

- A study of the technical feasibility of an open cycle floating power plant;

- A feasibility study for a closed cycle power plant.

The 1978-1979 French budget was six million francs (60 percent from the state and 40 percent from industry), whereas the U.S. budget was 140 million francs, entirely financed by the state. Japan as well has invested substantial funds. These two countries, therefore, have gained a certain advance, particularly in the area of big power plants generating over 100 megawatts, whereas the French studies cover generating power ranging from 1 to 10 megawatts. This is not necessarily a disadvantage, since a study of the market carried out by the CNEXO has determined that demand for this type of plant would come close to 1,000 units throughout the world.

Studies of long-term costs conducted by the CGE and Creusot-Loire have concluded that the cost of thermodynamic cycles, whether closed or open, are identical. The commissioning of an experimental open cycle plant on a floating platform would require no more than 2 years rather than 3 in the case of a closed cycle. This should affect the construction price of the second type of plant. Still according to the studies, the price per kilowatt hour would be the same for an open cycle plant as for a nuclear plant. Since, in fact, it is a question of a plant using solar energy, comparisons may be drawn with the future Themis Plant in the Pyrenees-Orientales: The electric power produced by the latter will be tenfold more expensive! However, subsequent improvements would increase its output.

In an open cycle the water from the warm sea is evaporated in vacuum (30 millibars) in an evaporator consisting of perforated strata. Naturally, it is assumed that the hot and cold water is taken or pumped to the machine. The biological materials of the sea water which are exposed to the brutal shock of a pressure loss would be largely destroyed. One may expect, therefore, a relative biological purity of the open cycle. This aspect is not unimportant in terms of material durability, for such installations should be operative for at least 25 years.

The pertinence of the "barometric concept" has been entirely verified: The least expensive solution in terms of the energy needed to maintain the vacuum of the evaporator or the mixture condenser (10 millibars) would be to place them some 10 meters above sea level. The turbine would work at normal air temperature and under low pressure. In order to avoid clutter and maintenance problems it would be preferable to use two turbines (6.7 meters in diameter) rather than one (9.4 meters in diameter)

to generate five megawatts. The turbines will have a single flow. Even though their performance is lower than three-flow turbines, these turbines are far simpler and, above all, less costly. The open cycle is, furthermor , capable of producing fresh water in substantial amounts (1,500 cubic meters daily per net megawatt) by replacing the mixture condenser with a surface condenser. This aspect could be of some importance in the case of a number of areas which are both short of energy and, frequently, fresh water.

Three types of plants are currently under study in France. All of them, however, are within the generating range of 1 to 10 megawatts.

The first will be located on dry land, this seeming to be the simplest solution. The technical constraint, however, will be tremendous. Whatever the location of the plant, it will require a source of hot and of cold water with a debit of 40 cubic meters per second (for a one megawatt plant). However, looking on firm ground for cold water per 1,000 meters in depth would require a pipe some 3 to 5 kilometers long, according to the slope, from the shore to the deep. Another problem involves the quality of the pipe (5 meters in diameter) and its laying: It must not be too heavy in order to be handleable. However, it must be strong enough to resist waves and weather changes, corrosion, and the hazards of the terrain along the slope. Laying the pipe would not be too complicated to the 300 meter level since at that depth human activities are quite commonplace in offshore petroleum drilling. Beyond that level, however, no human intervention would be possible and the problems might be quite difficult to resolve.

The second type of plant would use a recovery ship standing vertically over a depth of at least 1,000 meters which would be reached by the cold water pipe without too many problems. The cost of reequipping the ship (which should be at least 200 meters long) might be prohibitive in terms of profitability. All that is left, therefore, would be a floating concrete plant or else a concrete plant with a semisubmersible structure.

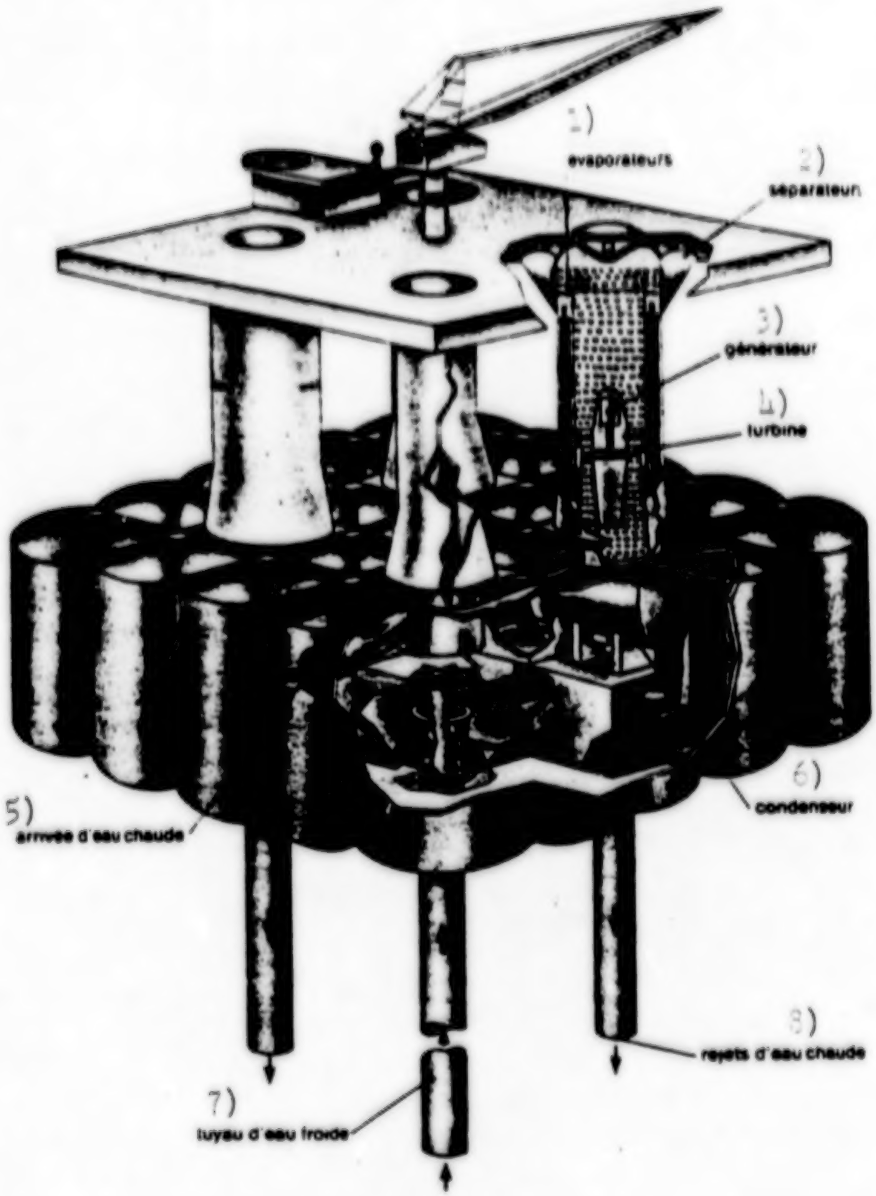
In Tahiti, which appears to be an ideal spot for this type of experiments (the sea is calm except for three percent of the time when the swell is slightly above 4 meters) a simple flat floating barge would suffice. The CGE has calculated that such a barge would be 50 meters long, 25 meters wide, and 6 meters high for a 3 megawatt plant. It would be made of concrete, for this is currently the least expensive construction material used by the branches of the Sea Tank Company which has the reputation of manufacturing the best oil drilling platforms in the world). The cold water pipe (3.5 meters in diameter and 1,000 meters long for a 3 megawatt plant) would be made of lightweight concrete whose density would be close to that of the water: In the upper part of the pipe a sliding buoy in a well would compensate for the vertical motion of the swell. The pressure of the currents on this round pipe would be low and, furthermore, compensated by a special anchoring. The anchoring of the barge or of the

semisubmersible structure would follow the principle of oil drilling platforms. We are aware of the importance of this matter since the accident with the Norwegian platform in the North Sea where the user, ignoring the opinion of the designer, had eliminated two anchors.

The open cycle is considered for low generation capacities only: For a 100 megawatt module the turbine's diameter would 70 to 80 meters! The Americans, therefore, have chosen the closed cycle using ammonia as work fluid. The aggressive nature of the marine environment requires the use of titanium for the exchanges and evaporators. Bearing in mind the cost and scarcity of the metal, the economic viability of the system has not been confirmed. In an open cycle corrosion problems are not so crucial. However, they do exist. Together with the CGE, the PUK has developed a special aluminum alloy whose composition has been kept secret.

Carrying the electric power to the land is not a major problem up to 10 kilowatts. However, very special cables will have to be developed for higher tensions. Such cables would also carry from the dry land the necessary power to start up the plant. After 4 hours of operation the plant could become self-supporting, consuming 30 percent of its own energy, particularly for the operation of the pumps.

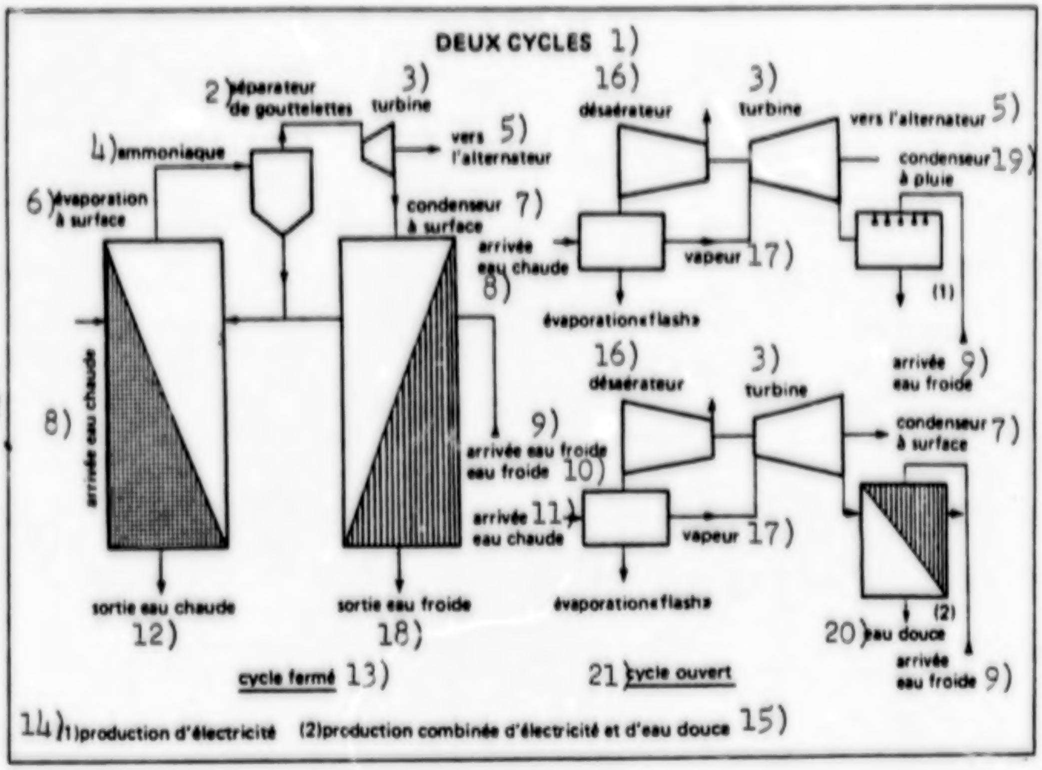
In addition to electric power, the open cycle plants could supply fresh water. The fact of bringing to the surface bottom waters which are very rich in nutritive salts, furthermore, should facilitate the nutrition of all living marine species. The manufacturing of particularly energy-intensive goods directly on the platforms has been considered as well. The profitability of the plants would not be excellent. However, they would consume no more than "sea water." Other plants call for the synthesizing of ammonia and the production of hydrogen, methanol, or ethanol. Some even more futuristic projects have been considered. The CEA is considering uranium filters: Not much uranium is found in sea water but the amounts of water used would be quite substantial. Furthermore, the CEA has asked the CGE to study the idea of a power plant which would use the hot water discarded by nuclear power plants.



Design of an open cycle platform by the Sea Tank Company, a branch of the CGE group. The price per kilowatt hour would be comparable to that of nuclear power plants.

Key:

1. Evaporators
2. Separators
3. Generator
4. Turbine
5. Hot water inflow
6. Condenser
7. Cold water pipe
8. Hot water release



Key:
1. Two cycles
2. Drop separator
3. Turbine
4. Ammonia
5. To the alternator
6. Surface evaporation
7. Surface condenser
8. Incoming hot water
9. Incoming cold water
10. Cold water
11. Incoming hot water
12. Hot water outflow
13. Closed cycle
14. Electric power production
15. Combined electric power and fresh water production
16. Deaerator
17. Steam
18. Cold water outflow
19. Spray condenser
20. Fresh water
21. Open cycle

Design of a floating power plant developed by the Sea Tank Company. The plant is of the open cycle type. The turbines are directly powered by the difference in the temperatures of the waters with no other lements.

5157
CSO: 3102

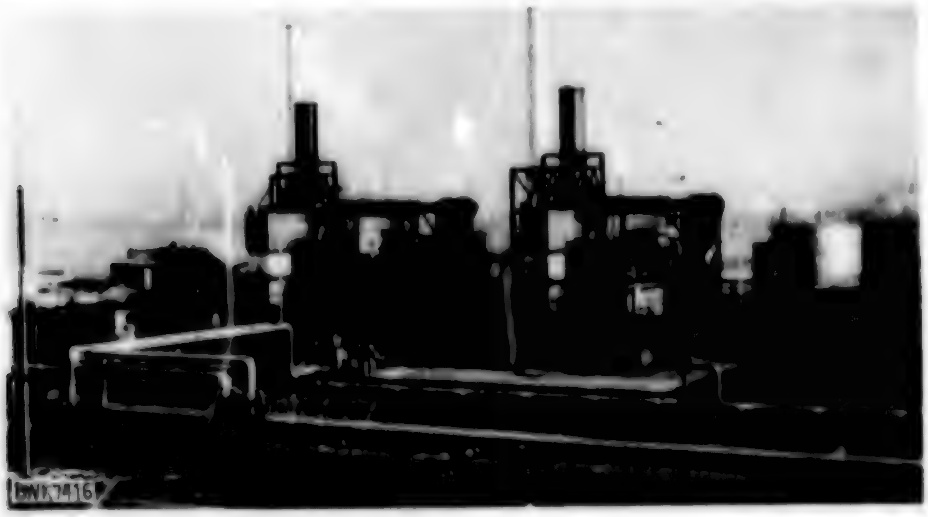
ENERGY

INDUSTRIAL CONCERN SAVES FUEL WITH COMBINED HEAT-POWER

Duesseldorf BWK: BRENNSTOFF-WAERME-KRAFT in German Jul 80 p 265

[Text] At ICI in Rozenburg (Netherlands) a plant with two gas turbines for the simultaneous production of electrical energy and process steam (energy-heat-coupler) has officially started up. It is beneficial for the industrial concern as the user, for the state and for the environment: the user satisfies the state requirement that no more natural gas be burned directly in the existing boilers for steam production only, it now gets part of the electrical energy for itself and lowers production costs because the process steam is produced from the hot waste gases of the turbines. The load on the public power grid is relieved so that--if other concerns follow this example--no additional public generating stations will have to be built for the time being. The environment is not additionally polluted with SO_2, which would be the case if the boilers were converted to oil-firing. Calculations show that $11 \cdot 10^6$ cubic meters of heating gas can be saved annually at ICI through the use of this energy-heat-coupler.

The entire plant consists of the two gas turbines, each with a generator, which together feed about 10 MW of electricity into the factory power grid (25 percent).



Plant for Combined Production of Electricity and Steam With Sulzer GT3 Gas Turbines in the Netherlands

9581
CSO: 3102

PHOTOVOLTAICS INDUSTRY REVIEWED

Paris INDUSTRIES & TECHNIQUES in French 20 Jun 80 pp 20-25

[Article by Marie-Jeanne Husset: "Photovoltaics: A Place in the Sun"]

[Text] There was the "calculation" plan, the "components" plan and now there is the "photovoltaic" plan. That is a sign of the interest placed by the public authorities in an industrial sector in a state of full expansion, supported by demand that finds expression primarily in exportation. While they await the market "explosion" in 1985, some companies are polishing up their weapons, making agreements and conducting research on the new processes that should make it possible to lower the manufacturing costs, still too high at present, between now and then.

The solar photovoltaic cell industry is being set up. It was high time. In view of the enormous sums devoted by the Americans to this technical line ($130 million a year), to the desperate eagerness of industrialists on the other side of the Atlantic to win the world market, French companies owed it to themselves to react. Now there are four companies committed to this course.

The pioneer and European leader, RTC (Radio-Technique Compelec) of the Philips group, has been manufacturing cells and modules for over 20 years now. In 1979, more than 200 kilowatts peak power were produced in its Caen plant. Every phase of the production of silicon cells and modules is handled there: drawing of the monocrystalline silicon bar (by the traditional Czochralski method), cutting in slices, production of connections and contact points, assembly of cell links and then encapsulation in a double glass structure.

Over the years, five generations of modules were put on the market in succession. The latest one, which came out in 1980, is made with two half-cells, 100 millimeters in diameter and delivering 16.5 watts with 16.5 volts.

RTC modules have the reputation of being particularly reliable, but they are among the most expensive ones.

France-Photon, a 70 percent subsidiary of Leroy Somer and 30 percent of the American Solarex Corporation (one of the first companies in the world specializing in photovoltaics), was established in 1978. At first, only encapsulation was performed in its Angouleme plant, using cells bought from Solarex, in the United States. Very recently, it has been manufacturing the cells also in accordance with the technology of the American company, that is to say by using semi-crystalline silicon. This year, its production might be 200 kilowatts.

Photowatt International SA was established in 1979 by Cipel and Saft, two companies in the CGE group and the American Sensor Technology Company. It specializes, in its Argenteuil plant, in supplying complete assemblies, true photovoltaic systems including, in addition to modules mounted in panels, storage batteries (for storing energy) and an electronic regulator handling the storage operation. In June, a shop for manufacturing monocrystalline silicon cells will go on line. It will produce 125 kilowatts peak power a year.

Sahel, the youngest of these companies, is a subsidiary of Thomson-CSF and of EXXON, the American oil company. For the time being, it handles the marketing of systems using Solar Power (a company in the EXXON group) modules, but it plans to go farther.

Oil companies are also interested in photovoltaics. The French Petroleum Company, in the TOTAL group, is seeking to develop cadmium sulfide cells, while ELF Aquitaine is partial to the Sophocle concentration system developed by CNRS (National Center for Scientific Research) (it consists of increasing the output of the photovoltaic cells by concentrating sunlight by means of Fresnel lenses.

Objective No 1: Cost Reduction

In 1980, the total production capacity of solar cells will amount to 1 megawatt peak power, keeping France in second place behind the United States. In 1985, French production might reach 25 megawatts, or a fourth of the world's production at that time.

Of course, aside from RTC, all the companies have acquired American technology. "Our aim was to start up quickly without waiting for the several years absolutely necessary for developing a specific technology," their executives state. Therefore, one imperative: enter a world market that should undergo an exceptional expansion. Because French industrialists are aiming primarily at export trade. Ninety percent of the present production of modules and systems are thus intended for construction in African countries and in Polynesia. Nevertheless, a domestic market is taking shape for supplying isolated sites, not very accessible to electricity networks, with

power: mountain huts, firefighting stations, sea buoys, telecommunication relays.

The public authorities have decided, on their part, to promote this emerging industry. COMES [Solar Energy Commission], which is allocating 28 million francs this year to photovoltaics, is thus buying one-fourth of the module production by carrying out a policy of order grouping.

Moreover, COMES, with the Ministry of Industry, set up a photovoltaic plan," similar to the "components" plan, several years ago. Some 500 million francs could be released in 5 years (from 1980 to 1985) to assist research and investments. Industrialists have been invited to submit their projects. "The aim," Yves Chevalier of COMES states, "is to group efforts, to assist those who seem to be best situated in each activity." One single program has been decided on, for the present, by the public authorities, the CGE program.

The objective that all are seeking to attain is a reduction of costs. In order for the market really to "explode" in 1985, the specialists estimate that the price of a peak watt is around 15 francs compared with 40 to 50 at present. The Americans have proclaimed a still more ambitious objective of 70 cents (or around 3.50 francs). In order to achieve it, not only must improvement be made in the present manufacturing processes, but also research must be continued to develop new technologies.

Production of Silicon for Solar Use

Completely upstream, research pertains to the basic material and its shaping. Silicon is still the material used the most and it is the most promising, because it has a photovoltaic output definitely greater than the output of the other materials considered.

Obtention of a thin plate of silicon, with an area on the order of a square decimeter, is the first step in manufacturing a solar cell. In the present production plan, the plates are obtained by cutting monocrystalline ingots similar to the ones used for electronic components.

These ingots are drawn from polycrystalline silicon produced from silica.

In view of the increase in demand for solar cells, a shortage of polycrystalline silicon is developing and prices are climbing continuously, exceeding 35,000 francs a kilogram. The large world producers, the German Wacker Company and the American Dow Corning Hemlock Company in particular, are investing very little at present to increase their production capacities, in the expectation of a "miracle" process that will make it possible to produce less expensive silicon.

Now, the material represents 30 percent of the cost of a solar cell. Moreover, photovoltaic cells might put up with a less pure silicon than what is used for electronic components. The problem is beginning to be felt in France where, up to now, there is no producer of polycrystalline silicon.

In order to fill this gap, two French groups, Rhone-Poulenc and PUK [Pechiney-Ugine-Kuhlmann Company], have undertaken studies to develop a new process for manufacturing silicon for solar purposes. With the blessing of the public authorities. Objective: achieve a price of 50 francs a kilogram.

The first-named company has been associated with CGE for a little over a year now. The second one signed some agreements with Thomson-CSF last March. Cooperation of chemists with cell specialists is indispensable, because only cell specialists are capable of testing the material obtained.

Although Rhone-Poulenc remains silent on its research, we know a little more with regard to PUK. "We are interested in silicon for solar purposes, because we are already a world leader in metallurgical silicon with a production of 70,000 metric tons a year. We have expertise both in metallurgy and chemistry of its compounds. Moreover, this might be a very large market, because it is estimated that requirements in 1985 might amount to 2,500 metric tons a year, compared with 20 metric tons a year at present."

Several processes are contemplated:

It is possible to purify metallurgical silicon chemically by dissolving the impurities or by volatilizing them, or else physically by recrystallizing them.

It is also possible to use chlorinated silicon compounds reduced by means of metals with a great affinity for chlorine. PUK has much experience with the carbochlorination of minerals. Finally, it is possible to proceed on the basis of compounds containing fluorine, the residue from the manufacture of phosphoric acid.

It will be necessary to wait 2 or 3 years before knowing which process will offer the best compromise between prime cost and purity.

Fifty percent of the research both at PUK and at Rhone-Poulenc is financed by COMES within the framework of the "photovoltaic plan." But, after all, it is likely that one single producer will stay in the race. Therefore, competition is keen.

This research work has a certain amount of risk attached to it, especially since, at present, it is not sure that crystalline silicon will be the material of the future. There are competitors: cadmium sulfide, for example. But these cells still have too limited a life and the conversion output is still low, on the order of 5 percent. But the most serious competitor is amorphous silicon. It is inexpensive and lends itself well to industrialization. Its only disadvantage is that, theoretically, it is not photovoltaic. In 1976, a team of Dundee university men discovered that doping amorphous silicon with hydrogen made photovoltaic conversion possible. Then, a number of research tems worked on this matter, especially

in the CGE laboratories in Marcoussis and in the Central Research Laboratory of Thomson-CSF. A number of problems still have to be solved. The output does not exceed 5.5 percent, while 10 percent is regarded as the practical minimum. It is not certain that this threshold will be reached. Basic research must continue for an understanding of the phenomena. If this research is successful, large-scale use of solar energy could be made, because amorphous silicon, obtained by decomposition of a gaseous compound, lends itself to the production of very thin layers, with an area as large as desired. (These thin films are laid on a substrate by decomposition of silane in a radiofrequency plasma).

Semicrystalline Silicon and New Methods of Shaping

New methods are also being sought for shaping silicon, in order to avoid the disadvantages of the present process of drawing a monocrystalline ingot. This process is very expensive. Moreover, 50 percent of the material is lost by sawing the bars to make the slices.

There is a trend toward the production of semicrystalline silicon cells. Advantage: they are easier to shape, especially with continuous methods that avoid sawing. This lowers costs and compensates for their lower output.

Several techniques might emerge in the near future. One of them, studied at Marcoussis (CGE), consists in producing parallelepipedal silicon ingots with large-sized grains by means of controlled pouring and cooling. Simplification of the crytallization apparatus, shape of the ingots and increase speed of growth make it possible to anticipate sizable reductions in cost. On its part, Leroy Somer Company is developing the technology of SEMIX (a subsidiary owned 70 percent by SOLAREX and 30 percent by Leroy Somer), an American company already manufacturing semicrystalline silicon.

Research is also being conducted to draw a ribbon that can be cut up continuously. The LEP (Philips Electronic and Applied Physics Laboratory) is working on a method for producing thin layers of semicrystalline silicon deposited on carbon substrates, in collaboration with Carbone Lorraine.

PUK is also interested in shaping the material, within the framework of its agreements with Thomson-CSF. Two processes are being tested: one, studied in the Jarrie Laboratory, makes it possible to obtain silicon strips directly by means of continuous pouring. The other one consists in depositing a volatile compound of silicon on a substrate.

In order to lower the cost of photovoltaic systems, it is also necessary to improve the manufacture, strictly speaking, of cells and encapsulation in modules by automating the operations as much as possible. The silicon slice must undergo several processings to become a solar cell. The surface has to be cleaned. The silicon has to be doped by causing the diffusion of the atoms of another element, donor or acceptor of electrons.

Metal electrodes have to be deposited to collect the current. This deposit is often accomplished by means of evaporation in a vacuum. This method is being replaced increasingly by less expensive and more easily automated serigraphy.

In every plant -- the RTC plant in Caen, the Leroy Somer plant in Angouleme, the PHOTOWATT plant in Argenteuil -- new production lines with better performance are being developed.

Therefore, each one is preparing for the market explosion expected around 1985. French industry, which is well situated, might take a choice place in it.

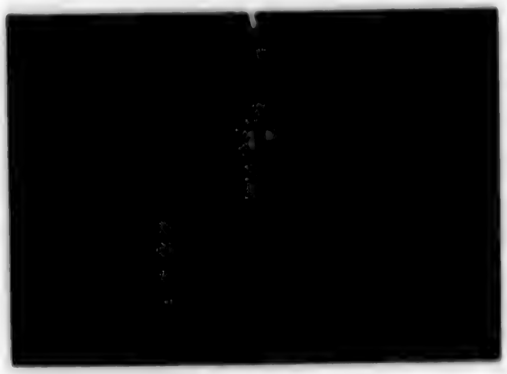


Diagram illustrating the method of preparing the polycrystalline silicon ribbon, called the split crucible method. This method, which was studied by the applied physics laboratory, with the support of COMES, is compatible with the continuous drawing process.
Key: 1. carbon substrate; 2. polycrystalline layer; 3. melted silicon; 4. direction of drawing; 5. meniscus; 6. crystallization face; 7. high-frequency loop; 8. crucible

At present, French solar photovoltaic industry (cells, modules, systems) is working 90 percent for export. Some countries, like in Africa, lend themselves very especially to the use of photovoltaics. The above photograph shows a French product in Saudi Arabia, where RTC has installed a power supply system for beacons in the Medina airport.

10,042
CSO: 3102

BRIEFS

WASTE MATERIALS COMBUSTION METHOD--An experimental model of a combustion process for special waste materials was developed at the Juelich Nuclear Research Facility (KFA) and has already been applied in large-scale industrial use. The "Juelich combustion process" is characterized by a two-stage process. The waste materials are thermally preconditioned in the first stage using heat generated by the process itself and burned pollution free in the second stage. The first large-scale technical installation has been in operation for several months in a plastics fabrication plant. With a throughput of 400 kg/h foils and felt, plastic, rubber, packing materials, office trash and production residues are burned automatically. The heat is used for the production of high-pressure steam for the factory power plant, resulting in an annual savings of approximately 850 tons of heating oil. Brennstoff-Waerme-Kraft, Power Installations AG, Heidelberg, P.O. Bo. 10 34 20, 6900 Heidelberg, FRG [Text] [Duesseldorf BWK: BRENNSTOFF-WAERME-KRAFT in German Jul 80 p 295] 9160

CSO: 3102

SWEDEN'S VOLVO'S CADAM SYSTEM DISCUSSED

Stockholm NY TEKNIK in Swedish 24 Jul 80 pp 8-9

[Text] Volvo's need for computer power has increased thirtyfold in the past few years. The competition on the world market demands that the computer revolution progress more quickly in this field than in any other Swedish manufacturing industry. This is the second of three reports from Volvo's headquarters.

This Is How the Computer Designs the New Volvos

When the Volvo of the future gets built, computers will participate in the routine work. Four computer systems will design the bases for the computerized construction system. The use of computer terminals as electronic drafting tables has definitely made inroads. Some commentators maintain that this technology has the most potential for the improvement of industry since the harnessing of electricity.

In a similar manner to other factories who have begun to use computer terminals for electronic drafting, the tendency at Volvo is to depend largely on complex geometry and parts which are generated in NC machines. This is the most productive way to utilize electronic draftsmanship.

One in-house program development for Volvo automobiles, before the sculptured surfaces will be dealt with, is the computer designing of the motor, which is in operation today. As a supplement, the firm has adopted the CADEM (Computer Assisted Design and Manufacture) system, developed by the American aircraft company, Lockheed, for generating and recording design crafts, for a trial period of one year.

Three Times as Many Terminals

During the seventies, Volvo's research and development department acquired a large number of computers. Today they are used on four levels, from cars and test equipment to the construction department's large computer (Burroughs 7800). Among other things, 123 nearby terminals are dependent on this big computer. Sixteen of them are "graphic" ones (Tektronix 4013 and 4015). This is three times as many terminals as the firm had only three years ago.

The designers have access to further calculation capacity at the affiliated firm, Volvodata. However, Volvodata mostly serves administration and current production.

Disagreements About Time Gains

These developments naturally have great significance for productivity in the design department. If you compare the time a designer spends at a computer terminal with the time he would take at the drawing board or in manual NC programming, the time saved is impressive, according to Lockheed. That firm has long experience in this field, and describes the situation in the summer issue of its quarterly journal HORIZONS.

"Productivity studies evaluate the CADAM system as 4:1 and 17:1 better than the older methods," Lockheed research chief Samuel J. Smyth writes. The ratio 4:1 refers to mechanical installations and the production of instructional paper for the NC machines. 17:1 is the representative figure for the programming of changes in construction detail with the CADAM system.

Lockheed has also recently undertaken special programs which work together with CADAM. These involve the design of surfaces, etc., converting CADAM designs into three-dimensional models.

"In one case when we were using the surface design program, our productivity rose to 40:1," Dr. Smyth writes.

This assertion incited the Volvo data technicians to an irritated protest. "Impossible," they said. "CADAM is not a system for surfaces. That last statement is a lie."

Within the automotive industry, CADAM yields less time gains, because the designs often contain information about double-curved surfaces, which have not previously been handled by CADAM, the technicians emphasized. (The surface design program handles inside surfaces, rather than outside ones). But within the area Volvo has made a lot of progress in the area of research and development.

Since both Lockheed's and Volvo's claims are based on their own experiences, it is not easy to determine which is right. But this much is clear and non-controversial: the electronic drawing board is here to stay. And there is certainly room for development on it. Also, non-biased instances in the USA have made it obvious that these methods have the greatest potential for speeding up progress since the harnessing of electricity. Both words, but worth remembering.

Sculptured Exterior Surfaces the Main Problem

Compared with the shipbuilding industry, Volvo has come so far with its CADAM projects that it was more natural for Volvo than for any Swedish shipyard to draw up the construction plans for Pelle Petterson's racing boat Sverige, according to civil engineer Sven Holmberg. He is associated with AFB in their research and development department.

"There are few manufacturers of CAD equipment who understand the special needs of the automotive industry," says Sven Holmberg. "The area which is particularly specialized involves the sculptured surfaces, that is, the inner and outer surfaces of the chassis."

The computer plans for Volvo automobiles can be summarized briefly as follows:

--During the period 1965-75, new testing techniques based on computer power were introduced.

--In the years 1975-85, new construction techniques were planned for.

--In 1985-95, new techniques for production preparation will be initiated.

That is the way the plan looks. At present the factory in Olofstrom is gradually replacing its copying machines with NC machines. Thus part of the foundation is being laid for putting the plans into action.

Developed Quickly Since 1966

A glance into the past, a little ways back in time, shows the following data for the construction department: Between 1966 and 1973, technical calculations began to be made by computer at a fast-growing rate. In 1968 the first automated laboratory was built, with an updated version in 1972.

As early as the late sixties, Volvo started to investigate numerical methods for chassis construction, but good mathematical descriptions for surfaces had not yet been perfected. The situation is completely different today.

The overflow from the research and development work in the automotive industry, according to Sven Holmberg, will be channeled into four systems which will contain data bases. They are SVEP, the form-determination system for designing; CADAM for drafting; KDP, involving detailed construction data for automobiles; as well as a not yet completed system for functional and specificational data. The latter will take the form of a relational data base.

These systems and a large number of calculating programs will form the building blocks...[next page not provided]

Captions:

1. NUFO (numerical formulation) is generated from a central list of functions. According to this list, the designer can choose one of the following programs: Datadisplay--listing/changing of coordinates, etc.; plotting of the location of the coordinates; front chassis diagram (pictorial calculations relative to that plotting); recording of the pictorial result.

2. Even the generation of designs with the help of the CADAM system can be incorporated into the NUFO system. The designing system is considered at Volvo to be principally a purely "electronic drawing board," whereas further numerical formulation is accomplished in the individual programs.

3. From the central list of functions, the designer can have direct access to the package calculations (fenders, steering wheel). He also has access to geometrical data (pictorial calculations, design and plotting/drafting). He can also plot finite elements for a string of calculations and then he can signal the computer when to stop.

4. There are a few construction parameters which need to be combined with the definitions for wheel suspension in order to give all the results presented here. These can also be generated quickly by a designer and would result in more generated designs.

9584
CSO: 3102

INDUSTRIAL TECHNOLOGY

AUTOMATION INTRODUCES UNMANNED GRAVEYARD SHIFTS

Frankfurt/Main FRANKFURTER ALLEGEMEINE BLICK DURCH DIE WIRTSCHAFT in German 7 Aug 80 p 7

[Article: "Instead of Overtime, the Fully-Automatic Night Shift"]

[Text] hh. Frankfurt, 6 August--In ever more far-reachin emizing and automating using modern computer technology for control, ins umentation and real-time data flow in manufacturing control, installations and machines are being developed which are also suitable for unmanned production. Thanks to a high degree of automation, the operator is largely freed from heavy physical and monotonous labor. In the following examples it is shown how in one case the "graveyard shift" is realized and in the other how manufacturing control is made to include transportation and inspection.

Presently, machine riggers of the Reutling firm Burkhardt + Weber are setting up at the Swedish firm Asea a machine for the unmanned third shift in response to the new worker participation law which bans overtime. Because of this law. the third shift can no longer be manned. As a result, Asea investigated he possibility of additional productivity through unmanned manufacturing on the third shift. The study showed that new investments with about 60 percent efficiency are justified and that operational safety could be increased by continuous use.

Since the new development assured the correct presentation of parts for assembly and since the measurement, checking and inspection tasks were integrated in the machine functions, this business was ideal for the new machine which produces frames and covers for electric motors. During the night shift it is necessary to employ only a single "supervisor" for a whole line of such machines. However, the machine can, for instance upon breaking a tool, make the proper decision by itself because of a high degree of intelligence.

As the basis for the installation, an already proven machining center is used which, with a pallet magazine for eight places, has the capability to carry the complete work provisions for the third shift. According to

information from Burkhardt + Weber, equipment for the following tasks is planned: monitoring of idle time of the applied tools; tool breakage checking by interrogation with a scanner; adaptive control of the throughput speed as a function of the degree of tool dulling; larger external program storage with the potential for storing all required programs directly on the machine; automatic measuring equipment for inspection and measurement purposes; large tool magazine for 60 tools; encoding equipment on the pallets which makes it possible for the machine to uniquely identify the tool pallet; and automatic updating of the pallet coding after a successful machining operation. The required work processes such as milling, boring, drilling, sinking, precision milling, precision drilling and thread cutting are carried out one after the other. Theoretically, up to 999 different programs can be stored in the external program storage which has a capacity of 256 kilobytes.

In the second example it will be shown how, after the third quarter of 1980, production control of parts in a gear factory will take over, control and speed up transportation and inspection by means of a computer. After continuously expanding over a period of time an operations data acquisition system from DPI-NCR, the gear manufacturing firm Renk AG in Augsburg is now in a position to realize planned future versions. Within the domain of manufacturing control there exist plans for a central job control station with CRT display and hard-copy equipment.

For redundancy purposes two processors are being installed which will monitor each other and when necessary can take over each other's activities. Normally, they will work separately: processor 1 for materials and material economics; processor 2 for manufacturing control. Since at Renk mechanical processing is not the only operation, the actual machining time amounts only to a maximum of 15 percent of the total throughput time and transportation, inspection, waiting and search times account for 85 percent. These nonmachining times can be reduced substantially in the future by the control center.

Internationally, Renk has made a name for itself in gears and transmissions for ships, tracked vehicles, power plants, steel and rolling mills and chemical and plastics plants. For this many faceted production program, a comprehensive operations data acquisition system (BDE system) from NCR-DPI was installed. Today in Augsburg about 70 BDE terminals are in operation and expansion to 100 is planned.

The processor works 24 hours a day with operations data acquisition directly at the work station. Operation of the system is simple and thus creates no problems for guest workers. The operations data is stored and managed on disks (presently 40 million [bytes]). The system installed at Renk will, according to NCR be used in the following divisions: work preparation, order writing, material receiving and inspection, material (recall material inventory, disposition, logging of withdrawal/availability), sales (contacts, checking, recall of inquiries, offerings and orders), scheduling office (schedule control, overall planning), timekeeping office (recall labor ledger, time validation, pickup, presence), operations (labor time, manufacturing control).

NATIONAL SCIENTIFIC RESEARCH INSTITUTE TO BE REORGANIZED

Lisbon EXPRESSO in Portuguese 26 Jul 80 p 10

[Article by Cruz e Silva, university professor, president of the INIC [National Scientific Research Institute] and president-designate of the LNICT: "Present and Near Future of the National Scientific Research Institute"]

[Text] On two or three occasions EXPRESSO has published editorial articles about the National Scientific Research Institute in which, in addition to criticisms as sharp as they were baseless of the officials in charge, absolutely false accusations were made and situations cited concerning the operations of the institute.

At the time, the president of the institute deemed it best not to enter into fruitless polemics, particularly since these articles suggested the desire for a personal attack much more than a concern with the clarification of what is good or bad in the organization and operations of the institute. The proof of this, moreover, lies in the fact that a duly documented file was sent to EXPRESSO in timely fashion, proving the falsity of the information published and the lack of foundations for the criticisms made. Truly exemplary were the fact that the responsibility for failing to sign an agreement with the National Center for Scientific Research (CNRS) lies with that body, not the INIC, and the claim that the INIC rejected applications for five trips between Geneva and Lisbon within the framework of the contacts established with the European Center for Nuclear Research (CERN).

Now despite all this documentation, the newspaper did not see fit to clarify the articles in question.

However now that the report of the activities of the INIC for 1979 is being prepared for publication for the first time, we deem it timely to provide the readers of EXPRESSO with a picture of what in fact the activities of the institute have been, through as brief as possible a summary of the contents of that report.

1. At the outset it should be stressed that never have such serious and so many obstacles to the normal functioning of the INIC been created as during 1979, but neither have so many activities ever been pursued as during that year. And this despite the economic and financial difficulties resulting from the lack of a timely definition of a scientific research policy, supported by the general state budget with funds allowing Portugal to emerge from the underdevelopment in which it finds itself in this realm, despite the efforts of some and the goodwill of others.

2. It should be mentioned that these obstacles were created by those of whom this would least be expected--government officials with responsibilities in the scientific research sector.

First of all, by means of ruling 112/79 dated 24 July, the then minister of education and scientific investigation sought to remove from the jurisdiction of the INIC its approximately 100 centers, at which more than 400 research projects were awaiting development and where about 1,900 researchers and assistants and 900 technicians and auxiliaries worked directly or indirectly under the jurisdiction of the institute. The office of the president and the scientific-consultative bodies of the INIC were from the very beginning opposed to this measure. The centers were not consulted, and, without any prior effort to effect a real reorganization of the institute, an effort was made after its first 3 years of operation to move once again toward a solution ill adapted to the realities and needs in Portugal. And in addition to all this, such a solution departs from the system in the majority of the European countries, where the institutes akin to the INIC maintain research units they finance under their direct jurisdiction.

3. But a greater obstacle yet was placed in the way of the normal activities of the INIC when the minister for science under the fifth constitutional government at that time sought the pure and simple elimination of the institute. In other words, the Ministry of Education would be deprived of any body or department to coordinate and finance university-level scientific research.

The immediate and clear rejection by the consultative councils of the institute and the strong and widespread opposition of vast university sectors caused this plan to fail, forcing its conversion in the end to a mere proposal to transform the INIC into a university research coordination council under the jurisdiction of the Ministry of Education, and yet another absurd effort to remove the research centers from direct dependence on the institute.[1]

4. It is obvious that these events hindered not only the normal development of the activities of the INIC, but more important the pursuit of the study of the institute's own proposed and most necessary reorganization and restructuring measures, only possible in an atmosphere of calm contemplation, which is essential to the making of choices which, apart from costing the country dear, will dictate its future in a positive or negative way.

Fortunately, above and beyond the successful defense of the identity and integrity of the institute, it was further possible, thanks to great effort and persistence, to ensure that 1979 was characterized by a clear expansion in the activities of this institution and the resolution of problems which had long since been demanding action.

5. There were four main goals I proposed to achieve in the short run when I was installed as the president of the INIC at the end of October 1978, which I clearly set forth at the time.

The first had to do with the urgently needed effort to expand university-level research. I said then that " . . . it has become essential not only to allocate more funds to this sector than it has been receiving, but also to make a tremendous effort to rationalize the use thereof . . . . "

Indeed, in terms of the allocation of funds and in absolute terms, we fell short of the needs recognized by all. But in comparison to 1978 and in terms of planned use, the results achieved in 1979 leave no doubt about how much was done along the lines of achievement of the desired goals. For example, in 1979, about 265,000 contos were spent on the INIC research centers, representing an increase of 25 percent over the preceding year. (Plans for 1980 call for an increase of 50 percent over the 1979 figure in the funds for the current expenditures of the centers, which will make it possible to meet all the requests submitted, provided they are duly justified.)

In 1979 372 scholarships were granted or renewed for study in this country and 102 for study abroad, coming to a total of 29,300 contos, a sum representing an increase of 45 percent over the 1978 figure.

In terms of the number of scholarship students outside the country, the increase was more than 50 percent in comparison to 1978, while the increase seen in the same period for scholarship students in this country came to about 90 percent.

Again in connection with the scholarships abroad, it should be noted that the respective basic monthly sums were adjusted twice in 1979, with an increase of from 11,000 escudos to 24,000 escudos.[2] In 1979 215 trips by Portuguese teachers and researchers to foreign countries were financed so that they could present reports at international congresses or carry out work to complete their respective doctoral theses. A total sum of more than 6,000 contos was spent on such activities.

Similarly, the visits to Portugal of 51 foreign professors and researchers were financed (at a cost of more than 1,400 contos). These funds (about 7,500 contos in all) represent an increase of 650 percent in comparison to 1978, when only 998 contos were spent on such activities.

By the end of 1979, subsidies for the holding of congresses and other scientific meetings in Portugal in 1979 and 1980 totaling about 8,300 contos had been allocated (from the time the INIC was established to my assumption of office the grand total spent in this sector was 1,462 contos!).

In 1979 about 14,200 contos were allocated for publications of a scientific nature, making it possible to put out 23 single publications and 6 periodicals and to subsidize 18 periodical publications and 50 doctoral theses. The increase in this sector was 253 percent in comparison to 1978 (it should be stressed that where doctoral theses were concerned, subsidies, total in the vast majority of cases, have been granted for all applications submitted to the INIC since I took office, and all of those for previous years awaiting a decision--125 theses in all).

While plans called for the establishment of 15 new research centers in 1979, despite all the difficulties referred to above, proposals for the establishment of 11, 3 at the University of Lisbon, 2 at the New University of Lisbon, 2 at the University of Coimbra and 4 at the University of Aveiro, were submitted to the then-minister of science under the 5th government for approval. Unfortunately, they were not approved. It should be mentioned however that the present minister of education later approved the establishment of the 11 centers proposed in 1979 and also another 7 (3 at the University of Lisbon, 2 at the Technical University of Lisbon, 1 at the University of Minho and 1 at the University of Oporto), and it is further expected that by the end of the month of July 7 new centers will be established, making an overall total of 25 (25-percent increase over the number of centers previously in existence).

6. The second goal I proposed to achieve was the establishment of a personnel framework for the bodies under the jurisdiction of the INIC, which moreover had been planned since 1976, and in this connection I made the following statement when I took office: "Another problem to which a rapid solution must be found is the revision of the conditions under which the research, technical and auxiliary personnel provide their services at the INIC research centers. I plan to submit a draft plan for that personnel shortly, not only as a matter of equity, but also because a change in the present working conditions will be a factor in dissuading individuals of known value from leaving for other sectors, both public and private . . . ."

Therefore immediately after beginning my activities in the INIC, I gave priority to the work required for establishing that framework, as well as the reclassification of center personnel, which, however, due to the difficulties resulting from the effort to eliminate the INIC, I was only able to achieve on 29 December, with the publication of directive number 712-A/79, finally resolving the unstable and unjust situation in which the almost-300 persons covered by this process found themselves.

7. The third goal to be achieved had to do with the legal and administrative reorganization of the INIC, through the approval of a new

organic law and the other normative instruments which might prove necessary.

In fact, decree number 538/76 proved ill adapted to the full satisfaction of scientific research needs within the framework of the Ministry of Education and the predictable expansion in this sector, for which reason I stated when I took office that it was "essential to provide the INIC with an adequate potential such that it can effectively make concrete the planning, coordination and dynamization of the scientific policy of the Ministry of Education and Culture . . . " and " . . . a new organization and dimension for the research centers be studied and their nature and status clearly defined within the framework they require."

Therefore as of the beginning of 1979 the preparatory work for the planned reorganization of the INIC was begun and developed, although the completion and submission of the final text had to be postponed repeatedly as the vicissitudes the institute was experiencing became more acute. Despite this, however, it was nonetheless possible to prepare a draft legal text which the work group appointed by the joint ruling dated 29 October 1979 approved almost in full, calling for the drafting of a plan for converting the INIC into the National Institute for University Research (INIU), with the exception, obviously, of the preamble, since the scientific philosophy then prevailing called for the transfer of the research centers to the universities, for which that ruling called, and some minor aspects of a juridical-administrative nature.

After the installation of the sixth government, I appointed a new work group, by means of a ruling dated 28 February, including Profs Dias Agudo, Moreira Araujo, Rosado Fernandes, Walter Osswald, Mota Pinto, Simoes Redinha and the president of the institute, with a view to drafting a new proposal for the reorganization of the INIC within 30 days. This group of professors, taking the initial proposal drafted by the INIC as the basis of its work, unanimously approved a proposal which was submitted to the government for approval. It stressed two main purposes the INIC and all of its activities should serve--promoting scientific production in the sector under its jurisdiction and encouraging the training of scientists and higher educational teaching personnel. And all of this based on a simple, de-bureaucratized approach. "In reality," the draft said, "it is deemed suitable and prudent not to establish too complex a body or bureaucratic mechanisms which are too weighty, choosing rather an organization endowed with a certain flexibility so as to be able to adapt to the needs which will be felt in the future, without necessary recourse to extensive restructuring measures." When the proposed reorganization is approved, the future will pass judgment on the adaptation of the results to the goals sought.

8. The fourth goal it was my concern to achieve was the dynamizing of international exchange through better coordination of the relations between the INIC and the Ministry of Foreign Affairs "such as to be able to derive

practical usefulness from many of the cultural, scientific and technical agreements of which Portugal is a signatory, which unfortunately has not always been happening," as I said at my installation in office.

Now there is no doubt that much has been achieved in this realm, since the exchange of teaching and research personnel is currently considerable, making use of the programs for the application of the more than 35 cultural, scientific and technical agreements of which Portugal is a signatory, with the corresponding saving in foreign exchange. In a number of these programs, in the negotiation of which the INIC participated in 1979, specific provisions applicable to the scientific exchange between the INIC and similar institutions in other countries were included, moreover, in the texts drafted, resulting obviously in the intensification of the scientific relations of the institute on the international level.

As a result of the efforts pursued in the realm of international relations it should further be stressed that in 1979, the INIC was the institution chosen by the government of the FRG to take responsibility for the implementation in Portugal of a plan for offering scientific equipment in our country, within the framework of the scientific development program signed by the respective governments, a program which will be made concrete through the carrying out of joint research projects in Portugal.

According to what the government of the FRG has arranged, the scientific equipment valued at 2.7 million deutschmarks, or approximately 80,000 contos,[3] will be sent to various centers under the jurisdiction of the INIC. Plans call for the implementation of the agreement during 1980.

9. In view of what has been said, I think I can justly state that the INIC began a stage of reorganization of its organic dimensions and expansion of its activities in 1979.

The difficulties which arose in connection with the identity of the institute and its very existence prevented the achievement of much more. This however cannot prevent acknowledgement that the future of scientific research in Portugal will depend greatly on the activities assigned to the INIC, as the body for coordinating and dynamizing university-level research, which is indispensable to the scientific development of our country.

10. It is obvious that much is owed in connection with all of the activities pursued to the open and devoted cooperation of all those who serve at the INIC, from the members of the consultative councils--whose contribution is absolutely free--to all of the officials in the main departments of the institute. These people, moreover, serve with an absolute spirit of sacrifice, for while the initial organization of the institute calls for 93 posts, only 2/3 of these are in fact assigned and occupied. It is expected that with the approval of the new organic law for the INIC the personnel-structure problem will have a proper solution, for otherwise

the institute will not be able to operate under fully efficient conditions, however much effort is made by its officials and other employees.

11. I hope I have contributed to a better understanding of what the INIC has been doing and what its future prospects are. Since I have had no intention of engaging in any polemic, it is hoped that this text will suffice to provide proper information to all those, with a spirit which is more destructive than critical, who have been concerning themselves basically with creating a negative image of the officials of the INIC and the destruction of the body itself. Therefore, for my part, I would like to put an end to the matter, assuring these detractors that I do not intend to make any further public statement, unless in the future some case provides particular justification.

FOOTNOTES

1. The frontal opposition of the president of the institute to its destruction even led to a truly unprecedented situation. He was dismissed from his post by a joint ruling of the prime minister and the minister of education and science under the fifth government, which, a few days later, revoked that ruling on gaining a better understanding of the reasons underlying the proposed elimination.

2. Despite the increases reported, the increase in the number of scholarships exceeded that in the respective total annual cost, because the new foreign study scholarships are granted in September and October and in 1979, the domestic scholarships were not awarded until after the approval of the OGE (general state budget).

3. In 1979, the INIC budget for reequipping its 100 centers was 40,000 contos, from the investment funds of the plan (PIDDAP).

5157
CSO: 3102

DESMARETS CUTS TECHNOLOGICAL RESEARCH, DEVELOPMENT BUDGET

Brussels LA LIBRE BELGIQUE in French 9/10 Aug 80 p 3

[Article]

[Text] Commenting on his budget for 1980, Mr Desmarets, minister of planning and scientific policy, noted that the overall total in the national budget plan for science policy is rising to 43.9 billion, of which 20.5 billion covers the operation of 17 university establishments. Presently, Francophone institutions get more than 52 percent of these allocations, and the distribution by communities must gradually be brought to 55 percent for Dutch-speaking institutions [Flemish?] and 45 percent for Francophone institutions.

The report of the committee on cultural affairs and science policy explained the initial imbalance by the higher number of foreign students in the Francophone universities and by the marked preference of Francophone students for the more costly studies: the exact sciences and medicine, as well as by the free university network which is more advanced, older, and which bears a heavier financial burden.

The minister stressed the critical importance of the contribution science policy makes to efforts at industrial relocation and export development, for the balance of payments deficit grows heavier from each year to the next. Mr Desmarets hopes to be able to "remove the fat" somewhat from [the field of] nuclear research, in order to liberate the funds necessary for financing the research and development activities set down in the government's program of economies in energy and raw materials. When whole sections of our national industries (steelmaking, textiles, machine-building, ship-building, glasswork, etc.) seem to be foundering, only specialization and industrial diversification, as well as the profits that one can expect to be made from commercial sales of new products, seem adequate to turn the tide, according to the minister, who cities, among the new technologies to be developed, coal gasification, district heating, geo-thermal energy, solar energy, and heat pumps. A working group has been named for micro-electronics. Technologies based on biological processes (enzyme, cellular, and microbiological processes) also seem to offer substantial possibilities.

9516
CSO: 3100

BRIEFS

DATA SYSTEM DEVELOPMENT FINANCED--The state will, in the course of 5 years, spend 80 million kronor on the development of data systems and software which are independent of computer manufacturers. The purpose is, via new, low-cost user systems and programs to facilitate the introduction of computer technology in the industries and offices. The research, which will take place in cooperation with groups of computer users, will primarily be conducted at the universities of Stockholm, Gothenburg and Linkoping. [Text] [Stockholm NY TEKNIK in Swedish 17 Jul 80 p 10] 7262

CSO: 3102

TRANSPORTATION

'CONTROL CONFIGURED VEHICLE' UNDER DEVELOPMENT

Berlin DER TAGESSPIEGEL in German 9 Aug 80 p 11

[Article by Peter Raabe: "Airplane Built Contrary to the Rules"]

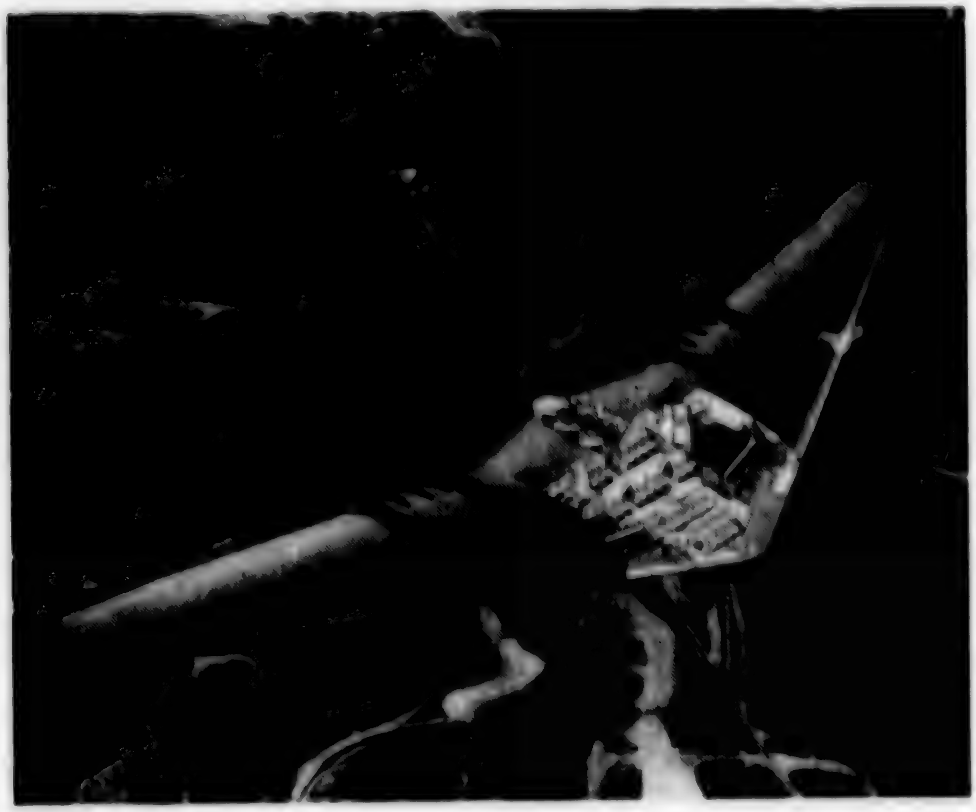
[Text] On the rudder of the F-104 G, whose stub wings are reminiscent more of a projectile than anytying else, the letters CCV stand out in glowing orange: they are an abbreviation for Control Configured Vehicle. Built by the Flight Research Center in Manching near Munich, it represents a suspension of the requirement which says that a good aircraft must demonstrate innate stability in flight. Instead, the airplanes of tomorrow are to be built with as much instability as possible; the reason is that they will have better performance and be more economical. The state of electronic control technology allows a complete restoration of the stability that the constructor has deliberately neglected.

Stability in this case has nothing to do with structural rigidity, but refers to the sense of balance of the airplane in the air. A properly trimmed aircraft returns by itself to its initial flight attitude after disturbances such as sudden wind gusts or turbulence. However, this inertia also has its disadvantages, as Dr Kubbat from Messerschmitt-Boelkow-Blohm explains: "Airplanes constructed according to the classical rules of stability place definite limits on the constructor. If, on the other hand, he does without natural stability and, in its place, creates artificial stability by electronic means, this can bring various advantages. Primarily performance and economy can be considerably improved..."

With this airplane built contrary to the classical rules of construction the aerodynamicist in particular has the opportunity for liberties in design that could not be risked previously. Flying wings are among the aircraft that are of special interest to him. Apart from the fact that they exhibit considerably lower drag than conventional airplanes, their structural weight is lower. The drawback is that they are difficult to control along their three axes, vertical, lateral and longitudinal. Hugo Junkers had applied for a patent on a flying wing as long ago as 1910, but until now similar machines on a large scale have scarcely progressed beyond the experimental stage.

Experiments in the application of the new technology were carried out on a plane that is the equivalent of the 300-seat European Airbus A-300. Compared with the naturally stable Airbus an electronically stabilized machine would have an 11-percent lower structural weight. The surface of the rudder could be reduced by one-half. Depending on what was desired, a 4-percent reduction in fuel, or a corresponding increase in the size of the passenger section, or an increase in range of 20 percent could be achieved. In addition, the CCV concept offers the possibility of absorbing stresses caused by particular maneuvers or wind gusts. This additional effect benefits material and passenger equally.

In order to transform CCV theory into practice with the experimental model, several fundamental changes were required which changed the physical appearance of the plane. Immediately noticeable is the canard foreplane located behind the cockpit but ahead of the leading edge of the razor-sharp wings. It helps to manipulate the center of gravity, which makes the aircraft enormously unstable. For the same purpose a 600 kg trim weight, consisting of thousands of tiny balls, is located in the tail. By means of this special equipment, the machine, which is deprived of its natural stability, can be restabilized electronically through special sensors. Among its other extras are the servomotors for the electro-hydraulic controls, located above the wings. The ailerons and elevators, actuated from the control column, are now activated electrically instead of by rods as before. This control system is not only simpler than the conventional mechanical one, it is lighter as well. For the pilot it is unimportant whether the plane responds predictably to his signals by one method or the other--naturally or activated by the flight computer.



Rendering of a flying wing jetliner: these planes, lacking fuselage, have lower drag and are lighter than normal aircraft with a fuselage and tail unit. Their stability is a crucial problem. Current technology, through which flight stability is created electronically, is opening up new posibilities for this type of construction.

9581
CSO: 3102

AUSTRIA TO PARTICIPATE IN AIRBUS INDUSTRY

Vienna PROFIL in German 18 Aug 80 pp 34, 37

/Article by Christian Ortner: "Success Is Begotten by Many Fathers"/

/Text/ In the aftermath of the Concorde fiasco, experienced aeronautic engineers are impressed by the joint European Airbus venture's dramatic success. As of 1981, Austria will be joining in.

The astronaut Frank Borman calls it simply "the best airplane money can buy." Boeing chief Thornton Wilson has flown it and found it "all right." And a member of Lockheed even goes so far as to say it is "the most remarkable resurrection since Lazarus."

They are all talking about the Airbus A 300, the first product of the European aircraft industry seemingly assured of complete commercial success. Until now, the Airbus industry salesmen have collected 415 orders and options. As Bernard Lathiere, the Airbus industry head puts it: "I really do not know the exact number; there are new orders coming in all the time."

The Airbus has thus penetrated the market which until now was an exclusive American preserve. Previously, the production of passenger airplanes was divided between Boeing, Lockheed and McDonnell-Douglas. Until the middle seventies, these three American firms turned out practically all passenger airplanes in the Western World.

The Jumbo jets in particular were an American monopoly until the Airbus came along. European airlines had to send their buyers across the Atlantic. These days, the buyers are headed in the opposite direction. Airbus is in the process of stealing a march on the American airplane manufacturers. Inside of 4 years, the Europeans were able to capture the

market. In 1976, not a single Airbus was sold; by now, some 60 percent of all new orders go to Toulouse where Airbus industry headquarters is located.

In this industrial city in the south of France more than 10 years ago, the European aircraft industry began to line up to challenge American preeminence. By applying gentle pressure and providing hard cash, the German, Spanish and French governments persuaded their ailing airplane builders to come up with a European Jumbo jet. The Airbus industry was founded, initially without the participation of the British government which was still smarting under the Concorde fiasco.

The participating firms* had suffered a variety of commercial setbacks. Aerospatiale of France was still digesting the Concorde disaster; VFW of Germany had taken a nosedive with its small, short-distance jet.

The birth of Airbus turned out to be correspondingly difficult. Each of the partners had different ideas on what kind of an airplane to build. The Germans opted for a small plane; the French wanted a long-range aircraft and the Spanish were forever short of money.

Once the participating governments gave the go-ahead signal and paid in an additional 15 billion Schillings, the various national construction teams worked out a compromise all along the line.

"Now everyone wants to know who the father of the Airbus was," Arno Evers, spokesman for Messerschmitt-Boelkow-Blohm (MBB), the German Airbus partner, says. "There was no one single person who built it; there were several hundred nameless designers."

In the early seventies, the prognosis was that the Airbus venture was sure to fail. When Bernhard Weinhart, head of the German Airbus Ltd at the time, stated in 1972 that "we will sell at least 400 of them," the American airplane builders merely smiled at the 78 year-old gentleman from Germany for his lack of a business sense.

* CASA (Spain); MBB (FRG); VFW (FRG); Aerospatiale (France)

In the meantime, the old gentleman's estimate has been exceeded and the American monopolists are wearing a pained and sour expression.

"We are not about to slash our wrists for losing an order to a competitor," Boeing chief Wilson said at a time when the newcomer's share of the European market had reached 50 percent.

For the time being, the American market gives Wilson no reason to go through with anything as spectacular as that. The Airbus managers have not been able to make inroads in the United States. "It is like trying to sell California red wines in France," Gilbert Galer, head of U.S. sales for Airbus, says in commenting on the American market.

The only exception to the "buy American" rule is Frank Borman and his Eastern Airlines.

At the end of 1976, Borman's airline was just as sick and close to collapsing as the Airbus industry which had not sold a single one of its products for a whole year and was literally fighting for survival. In fact, there is a marker at desktop level in the office of MBB spokesman Evers showing how high the water rose in 1976 when the entire MBB plant was flooded.

While fish were swimming around the landing gear of six unsold Airbuses parked at the Hamburg-Finkenwerder factory, Borman was himself looking for a life preserver to save his Eastern Airlines from going under. At that time, the airline was stuck with an array of uneconomical Jumbo jets which had too many seats and were therefore flying half-empty most of the time.

The banks turned a deaf ear to Borman's pleas. Nobody wanted to lend money to Eastern, teetering on the edge of bankruptcy, to say nothing of the millions Borman needed to revitalize his fleet of airplanes.

Airbus had at that time hired George Ward, a brawler of some renown, and sent him to America asking that he not return to Toulouse without a sheaf of orders.

George Ward had Borman invite him to breakfast. When he entered Eastern headquarters in Miami he ran into a Lockheed salesman leaving the building whom Borman had just thrown out.

Borman and Ward discovered they had a community of interests. Airbus had six airplanes standing around that it wanted to get rid of at any price. Borman wanted to buy some airplanes for as little money as possible.

Airbus rented the planes to Eastern for a half year without getting a cent for them.

Eastern found they could save one-third in fuel costs.

And Airbus found that Borman was ready to order 34 of their planes at a cost of more than DM 2 billion.

The spectacular triumph at Eastern was followed by an equally spectacular defeat at Trans World Airlines. Just a few hours before TWA was to sign an order for 20 planes, Boeing came up with an unique opportunity, offering TWA a loan covering 85 percent of the purchase price of a like number of 767's. Although Airbus would have matched the offer, Boeing did receive the order in the end.

All things being equal, it is the delivery date that counts. In that regard it looks bad for the Europeans. Since plant capacity is not big enough, none of the Airbuses can be delivered prior to the middle of 1985.

"In the next few years we are going to increase production tremendously," Arno Evers in Hamburg says. At present, a new Airbus comes off the assembly line every 11 days; by 1985, it will be two a week.

Stepped-up production raises problems of coordination for the Europeans which can only be solved by a battery of advanced computers. The plants involved in turning out the Airbus are scattered all over Europe.

The wings are manufactured in England by government-owned Aerospace which joined in as a partner at length; the cockpit is assembled in France; the fuselage in Germany, the remainder in Spain and the engines in the United States.

To get the individual sections to Toulouse, a special aircraft, nicknamed the super-guppy, was built which has cargo space large enough to accommodate the Airbus fuselage.

The guppy carries each Airbus fuselage from Hamburg to Toulouse where the sections of the plane are finally assembled. The finished Airbus then flies back to Hamburg under its own power where the interior appointments are installed. And then, back to Toulouse where it is turned over to the customer.

The crucial problem is timing. The Airbus sections manufactured in Hamburg alone consist of 90,000 separate parts which are not needed all at once but spread out over almost 2 years. It is quite a logistic feat to make sure that every single part is available on the exact day it needs to be installed. That is the only way of making certain that the fuselage from Hamburg can be welded to the wings from England on the same day. "Up to now, every Airbus came off the assembly line with two wings," Evers says drily.

As of next year our own Austrian Elin-Union will be part of this European logistic system. Elin-Union managed to obtain a sub-contract from MBB 2 weeks ago. For 100 million Schillings annually, Elin-Union will be processing aluminum parts originating in the FRG, turning them into struts for the fuselage of the newest Airbus model A 310.

This might be a way of cutting Austria's deficit vis-a-vis the Airbus industry in half. The Airbuses ordered by Austrian Airlines will cost about 2 billion Schillings. Assuming a 10-year running time for the Elin contract, it would bring back one billion to Austria again.

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